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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/885,046 | 06/21/2001 | Naoki Shibata | P 281498 T36-133525M/KOH | 3630 |
| 909 | 7590 | 04/10/2002 | EXAMINER | |
| PILLSBURY WINTHROP, LLP P.O. BOX 10500 MCLEAN, VA 22102 | | | HU, SHOUXIANG | |
| | | ART UNIT | PAPER NUMBER | |
| | | 2811 | | |
| DATE MAILED: 04/10/2002 | | | | |

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) |
|------------------------------|-----------------|----------------|
| | 09/885,046 | SHIBATA ET AL. |
| | Examiner | Art Unit |
| | Shouxiang Hu | 2811 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
 - Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 12 February 2002.

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-31 is/are pending in the application.

4a) Of the above claim(s) 8-31 is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-3, 5-7 is/are rejected.

7) Claim(s) 4 is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.

10) The drawing(s) filed on 21 June 2001 is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:

 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. ____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) The translation of the foreign language provisional application has been received.

15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) Notice of References Cited (PTO-892) 4) Interview Summary (PTO-413) Paper No(s). _____
2) Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) Notice of Informal Patent Application (PTO-152)
3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3. 6) Other: _____

DETAILED ACTION

Election/Restrictions

1. Claims 8-31 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 5.
2. Applicant's election with traverse of Group I in Paper No. 5 is acknowledged. The traversal is on the ground(s) that subject matters of Group I and group II are sufficiently related, and that search and examination of the entire application can be without serious burden. This is not found persuasive because, as stated in the Restriction Requirement set forth in the previous Office Action, inventions of Group I and Group II are distinct and have acquired a separate status in the art as shown by their different classifications. In addition, examination of claims in Group I drawn to a device requires a thorough search in each of the class/subclasses: 257/79, 86, 94, 13, 189, 190, 81, 85, 86, 90, 96, 101-103, 12 and 22; while examination of claims in Group 2 drawn to a method requires a thorough search in each of the class/subclasses: 438/22, 24, 46-48 and 956. And, search and examination of both Group I and Group II inventions would indeed impose a serious burden on the examiner.

The restriction requirement between Group I and Group II set forth in the previous Office Action is still deemed proper.

3. In addition, Applicant elected Species I of Fig. 5 in Paper No. 5, and identified claims 1-5 and 7 as readable thereon. However, claims 1-5 and 7 recite an undercoat layer having "a surface with convex portions each shaped like a truncated hexagonal pyramid" (see claim 1), which is readable on Species 2 of Fig. 7 and Species II of Fig. 9, but is unreadable on Species I of Fig. 5. (see Page 31, line 4 , through page 32, line 13, in the specification).
4. Nevertheless, for the purpose of avoiding unnecessary delay, claims 1-7 are all examined in this Office Action, with the assumption that Applicant intended to elect species II and/or III. Clarification of the species election must be made by applicant in replying to this Office action.

Claim Objections

5. Claims 1, 4 and 7 is objected to because of the following informalities/defects:
 - The term of "a group III" in claim 1, line 7, should read as --group III--.
 - The term of "is doped" in claim 4 should read as --also doped--or--further doped--
 - The term of "a function one of" in claim 7 should read as --a function of one of--.Appropriate correction is required.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1, 5 and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Sunakawa et al. ("Sunakawa"; 10-312971; of record).

Sunakawa discloses a Group-III nitride compound semiconductor device (Figs. 1, 3 and 6, especially Fig. 3; also see the computer translation provided as a rough reference), comprising a substrate (21); an undercoat layer (GaN; layer 22 and a lower portion of layer 25; see Fig. 3(a)); and group-III semiconductor layers (including 66-68 and 70-73) overlying the undercoat layer; wherein the undercoat layer having a surface with convex portions each shaped substantially like a truncated hexagonal pyramid (see Figs. 3(a)-3(c)).

Regarding claim 5, the substrate in Sunakawa can be Al₂O₃ (which is often a synonym of sapphire in the art) or SiC (see Sections 0036 and 0085).

Regarding claim 7, the GaN layers in Sunakawa have a function of a light-emitting device.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 2, 3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sunakawa et al. ("Sunakawa"; 10-312971) in view of Kern et al. ("Kern"; 6,194,742).

The disclosure of Sunakawa is discussed as applied to claims 1, 5 and 7 above.

Sunakawa does not disclose that the GaN undercoat layer can be doped with Mg. However, Kern teaches to form a GaN-base light-emitting device (Fig. 3; also see col. 3, lines 6-22, and lines 66-67), comprising a Mg-doped GaN undercoat layer (16), for increasing device reliability and reproducibility.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the semiconductor device of Sunakawa with the undercoat layer being doped with Mg, so that a semiconductor light-emitting device with increased device reliability and reproducibility would be achieved, per the teachings of Kern.

Regarding claim 3, the Mg concentration in the undercoat layer in Kern can be up to $5 \times 10^{21} \text{ cm}^{-3}$ (see col. 4, line 52-53).

Regarding claim 6, although Sunakawa does not expressly disclose that the device can further comprise a sedimentary layer between the substrate and the undercoat layer, Kern further teaches to include such a sedimentary layer (14) in the GaN-based light-emitting device. It would therefore have been obvious to one of ordinary skill in the art at the time the invention was made to further incorporate the sedimentary layer of Kern into the device of Sunakawa for improving the quality of the epitaxially grown GaN layers.

Allowable Subject Matter

10. Claim 4 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, and to overcome the claim objection set forth above in this Office Action.

11. The following is a statement of reasons for the indication of allowable subject matter: Prior art does not teach or render obvious a Group-III nitride compound semiconductor device, comprising a Mg-doped GaN undercoat layer, wherein the undercoat layer having a surface with convex portions each shaped like a truncated hexagonal pyramid; and the undercoat layer is also doped with an n-type dopant and is of an n-type overall.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reference B is cited as being related to a GaN-based light emitting device.

13. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15,

1989). The Group 2811 Fax Center number is (703) 308-7722 or 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Shouxiang Hu** whose telephone number is **(703) 306-5729**. The examiner can normally be reached on Monday through Thursday from 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Tom Thomas**, can be reached on **(703) 308-2772**. The appropriate fax phone number for the organization where this application or proceeding is assigned is **(703) 308-7724**.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **(703) 308-0956**.



Shouxiang Hu

April 5, 2002